# DISTRIBUTION AND ABUNDANCE OF JUVENILE COHO AND STEELHEAD IN GAZOS, WADDELL AND SCOTT CREEKS IN 1998

Jerry J. Smith
Department of Biological Sciences
San Jose State University
San Jose, CA 95192
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ABSTRACT: In August-October 1998 previously sampled representative sites on Gazos Creek and Waddell Creek and in the Scott Creek watershed were evaluated for habitat conditions and sampled by electroshocker to assess distribution and abundance of steelhead and 1998 year class coho. Sampling on Gazos Creek was also expanded by the addition of 3 upstream sites.

Severe winter storms rearranged channels on all three streams, and landslides and bank erosion resulted in many riparian and upland trees, primarily alders and redwoods, falling into or across the stream channel. Stream shading was only somewhat reduced, but the added wood resulted in a significant increase in the number of pools and almost a doubling of complex pools suitable for overwintering fish. Portions of streamside roads on Waddell and Gazos creeks were damaged by high flows, and many log jams and downed trees were removed on Gazos Creek by the San Mateo County Department of Public Works. Log jams still present on all three streams in late summer were not barriers to adult fish movement, and often produced complex pools used by juvenile coho. Although substantial amounts of sediment moved into and through the streams during winter flows, there was no significant change in the quality of streambed materials in late summer.

Spawning coho were abundant on at least Waddell and Scott creeks, but the severe winter storms apparently destroyed most redds. In Scott Creek watershed the 1995 year class had been restored in strength by spawning of precocial hatchery females, but the 1998 year class consists of few juveniles, primarily in Scott Creek upstream of Mill Creek. The very weak 1995 year classes on Gazos and Waddell creeks should have been bolstered in 1998 by spawning by precocial hatchery females, but only a few localized juveniles were captured on the West Fork of Waddell Creek and on upper Gazos Creek. As in past years, coho were larger than steelhead, because of their earlier emergence. The year classes on all three streams are too small to produce a viable coho spawning run in 2001.

Young-of-year steelhead were relatively abundant on all three streams, reflecting successful late season spawning and good rearing conditions due to high summer streamflows. Young-of-year steelhead were substantially larger at downstream sites compared to upstream sites on all three streams. Young-of-year steelhead

in 1998 were larger than in drier years on Waddell Creek and downstream portions of Scott Creek; they were similar sized on Upper Scott Creek and on Gazos Creek, where summer shading is densest. The number of steelhead yearlings captured was relatively low, perhaps due to heavy winter mortality.

Mortality of electroshocked fish on the 3 streams and on Redwood Creek averaged 0.6%; no juvenile coho were apparently killed.

## INTRODUCTION

Since all wild female southern coho (Oncorhynchus kisutch) spend one year in the stream and two years in the ocean prior to spawning (Shapovalov and Taft 1954), at least three consecutive years of study are necessary to determine the status of the three numerically independent year classes. This report presents results of the seventh consecutive year of sampling for juvenile coho and steelhead on Scott, Waddell and Gazos creeks in August through October 1998. Sampling in 1998 was especially important to determine the impact of the severe El Nino storms on coho redd and fry survival.

Previous surveys of Scott and Waddell creeks (Santa Cruz County) in 1988 and 1992-1997, Gazos Creek (San Mateo County) in 1992-93 and 1995-7, and Redwood Creek (Marin County) in 1988 and 1992-1997 have shown wide year-to-year variation in coho abundance within streams (Smith 1992, 1994a, 1994b, 1994c, 1995a, 1995b, 1996a, 1996b, 1997; Smith and Davis 1993). These wide coho abundance differences occur because the restricted spawning period, single spawning attempt, and rigid ages of smolting and spawning (Shapovalov and Taft 1954) make them susceptible to drought, floods or other "disasters" within small watersheds (Smith 1994c). For example, Redwood Creek in Marin County had very strong coho year classes in 1992, 1993, 1995 and 1996, but the 1988 and 1994 year classes were less than 5 percent as large (Smith 1996), apparently reflecting impacts to that three year brood cycle during or prior to 1988. The year class naturally rebounded to one-half strength in 1997 (Smith 1997). Steelhead (O. mykiss), however, have extended spawning periods, can spawn more than once, and are variable in ages of smolting and maturation (Shapovalov and Taft 1954). Therefore, steelhead juvenile abundance is more likely to indicate yearly rearing habitat conditions, and populations are less affected by, and will recover quickly from, bad years.

Previous electroshock sampling on Scott Creek found strong juvenile coho year classes in 1988, 1993 (January 1994 sampling) and 1996, but very weak year classes in 1992 and 1994 (Smith 1992, 1994a, 1994c, 1996b). In 1995 and 1997 coho abundance rebounded from the 1992 and 1994 lows, apparently due to spawning by precocial (2 year old), hatchery-reared females (Smith 1995b, 1998a). Scott Creek should have had a very strong run of spawning coho in winter 1997-98, due both to wild

production in 1995 and to precocial return of hatchery-reared 1996 year class fish.

Previous sampling on Waddell Creek found weak year classes in 1988, 1992 and 1995, a stronger year class in 1993 and 1996, but no apparent juvenile coho production in 1991, 1994 or 1997 (Smith 1994c, 1998a). Gazos Creek has previously shown coho abundance patterns similar to Waddell Creek (Smith 1996b, 1998a). However, both streams were expected to have significant spawning by precocial hatchery-reared fish (1996 year class) in 1997-98.

## METHODS

In September and October 1998 eleven previously-sampled Scott Creek watershed sites were sampled by electroshocking (Table 1). The three sites not resampled, on lower Scott Creek and upstream and downstream of the hatchery on Big Creek, were unlikely to have coho because of their absence at adjacent, more favorable sites. In September and October ten previously-sampled sites on Waddell Creek were sampled (Table 2). Henry Creek, West Fork Waddell Creek downstream of Henry Creek and near Last Chance Creek on the East Fork were not resampled because of difficult access and scarcity of coho at other, more favorable sites. In August and September all five previously sampled Gazos Creek sites were sampled (Table 3), and 3 new sites further upstream also sampled.

At resampled sites on each stream the same habitats were resampled in most cases. However, the winter storms had modified some habitats, so similar replacement stations were substituted. The length of stream sampled per site was similar to previous efforts in 1992-1997 (Table 4). Habitats sampled in 1998 included more pool habitat than previous efforts, even though most of the same habitat units were sampled. This was because the amount of wood and scour was substantially increased at many sites, so the amount of pool habitat available and sampled was increased (Table 4).

The primary goal of the sampling by electroshocker was to look for the presence and abundance of coho, so sampling since 1992 has concentrated on pool and glide habitats, and riffles were seldom sampled. At each site usually three to five individual habitat "units" (a glide or pool, with its contiguous glide and run habitat) were blocknetted and sampled by 2 to 3 passes with a backpack electroshocker (Smith-Root Type 7, smooth pulse). Sampled habitats were representative of those available, except for Waddell Creek, where large, deep pools on the main stem could not be sampled by electroshocking. Length, width, depth, cover (escape and overhead), and substrate conditions were determined, and percentage of habitat types assigned for each habitat unit. Rosgen channel type was determined, and relative abundance of pool, glide, run and riffle habitat types was also estimated for

the vicinity of each site (Tables 1-3).

Juvenile fish were measured (standard length, SL) in 5 mm increments, and young-of-year (YOY) steelhead were separated from older fish, based upon length-frequency at each site. Holdover hatchery steelhead could be identified by fin clips and/or worn, short dorsal fins, but none were captured in 1998. Mortality was kept to a minimum by reducing electroshocker voltage in shallow water and immediately placing captured fish in a floating live car. Mortality was recorded at the time of length measurements.

A small portion (2 x 2 mm) of the caudal fin was taken from coho, including 3 fish from Scott Creek not included in the density analyses. Fin tissue was placed in folded chromatography paper and stored in scale envelopes; the samples were air dried for several days and returned to the envelopes for final storage. Samples will be transferred to the Bodega Marine Laboratory for archival and genetic analysis.

## RESULTS AND DISCUSSION

### Habitat Effects of the 1998 Storms

The heavy February storm was at least as severe as the January 1982 storm, and heavy runoff from El Nino storms continued for much of the winter. On Scott Creek debris flows occurred on the smaller tributaries, plugging culverts and flowing across Swanton Road. Debris flows were also common on side slopes on upper Scott Creek (between sites 9 and 11A). The channel of Bettencourt Gulch, a spawning tributary immediately upstream of site 9, was severely scoured. On Waddell Creek landslides occurred downstream of the forks (at and above site 5) and on both the east and west forks (above and below site 9). Portions of the streamside road were destroyed above site 5 and also upstream of site 10. As in previous storm years (1995 and 1997) channel changes were greatest on and downstream of the East Fork. On Gazos Creek small slides were common on steep side slopes upstream of Cloverdale Road. Log jams were also common upstream, and the road was damaged at several locations. The San Mateo County Department of Public Works had many of the jams removed in May.

Although riparian and upland trees were toppled by landslides and streambank erosion, decreases in stream shading were generally localized. On Scott Creek declines in canopy closure of 5-10 percent due to 1997 and 1998 storms were limited to sites 1, 2 and 4, on lower Scott Creek. On Waddell Creek similar declines occurred at sites 2 and 3, and somewhat greater canopy loss occurred at sites 4 and 5; all sites were downstream of the forks. On Gazos Creek canopy declines were very minor at the 5 previously sampled sites and at log jam and landslide sites further upstream. Although there was substantial streambed

movement on all 3 streams, there were no detectable changes in substrate composition at any sites.

High flows and the addition of riparian and upland trees to the channel improved the number and quality of pools on all 3 streams. On Scott Creek the estimated amount of pool habitat at sites sampled in both 1997 and 1998 increased from 37 to 42 percent, and depth of resampled pools increased at 5 of the 11 sites (Table 6). Three new pools were created when redwood, Douglas fir and California bay trees fell into the channel, and 3 small log jams were formed at downed alders (Table 6). Complex woody pools made up 1/3 of pools at Scott Creek sample sites in 1998 (Table 7), but this type of habitat had increased 75 percent (Tables 6 and 7).

On Waddell Creek the estimated amount of pool habitat at sample sites increased from 40 to 45 percent, and pool depths increased at 5 of the 10 sites (Table 6). New redwoods, alders and Douglas firs created pools at 9 of the 10 sites, and complex woody pools increased by 79 percent (Table 6). In 1998 log jams and pools of large woody debris made up a majority of sample site pools (Table 7). Two large log jams present at site 1 in 1997 remained in place, but were passable to spawning fish. In 1997 the log jam at site 10 was plugged with gravel, forming a difficult barrier and filling pools upstream with trapped sediment. In 1998 the jam was partially open and passable, and trapped sediment had been removed.

At previously sampled Gazos Creek sites (1-4) the estimated amount of pool habitat increased from 28 to 32 percent (Table 6). Pool depth increased at only 1 site, and decreased at site 3, which was immediately downstream of a May logjam removal site; sediment impounded behind the jam, and released by its removal, may have contributed to pool filling. A net of 2 new pools and 2 log jams were formed at the resampled sites in 1998 (Table 6), increasing complex pools by 80 percent. With the 3 new sites included, large woody debris pools and log jams doubled (Table 7). Large log jams throughout the upper portion of the stream were removed by the county, and fallen redwoods, capable of forming complex pools, were cut and removed. On the lower portion of the stream many leaning or fallen alders were cut, leaving only the stump and upslope portions of the tree. Pools on Gazos Creek were less common than on Scott and Waddell creeks (32 percent of habitat versus 42-45 percent, Table 6), and were shallower. The removed wood could have helped to increase the amount of pool habitat and especially the number of deeper, complex pools.

In addition to fallen trees that formed new pools, a substantial amount of wood fell into portions of existing pools or into portions of the bankfull channel without causing new pool formation (Table 6). These additional trees were most common at sites on Waddell Creek (Table 6); a portion of those trees fell in mid to late summer, apparently as supporting soils dried out. Some of these additional trees may contribute to future pool

formation.

Juvenile Coho

In January spawning precocial female coho were common on the West Fork of Waddell Creek; the remainder of the stream was not checked for spawning fish. Spawning coho, including 3 year olds, were common in January on Scott Creek (Dave Streig, pers. comm.). Unfortunately the severe February storm, and subsequent storms, apparently destroyed most coho redds, and juvenile coho were extremely rare on Scott, Waddell and Gazos creeks in 1998. In addition to storm damage, the low juvenile abundance may also have been partially due to reduced egg viability. Six of the 7 1998 females spawned at the hatchery lacked viable eggs (Dave Streig, pers. comm.), which may have been due to high ocean temperatures due to El Nino (Bill Cox, CDFG pathologist, pers. comm.).

Scott Creek. On Scott Creek only 34 juvenile coho were captured at resampled stations (Table 1), less than 10 percent of the number captured in 1993 or 1996 (Table 4). Half of the fish were captured at site 11 on upper Scott Creek, where a pair of coho were observed spawning after the February storm (Dave Streig, pers. comm.). Most of the remaining captured fish came from Scott Creek between Mill Creek and mile 6.5 (Table 1); only 1 coho was captured from among the 5 sites on Big Creek, Mill Creek or Scott Creek downstream of Mill Creek. In previous years when floods apparently destroyed redds (February 1992, January and March 1995 and January 1997) juvenile coho were also rare or absent on upper Scott Creek (above about mile 5), in Big Creek, and on Scott Creek downstream of Big Creek (Table 9). However, in two of those years coho were still common on Mill Creek and abundant at the two Scott Creek sites downstream of Mill Creek (Table 9). In 1998 the flood impacts were apparently more severe and more widespread. The low density of coho present in 1998 is similar to that of 1992 and 1994 (Table 4). Those weak year classes were partially restored by spawning of precocial hatchery-reared fish in 1995 and 1997.

In 1998 the few juvenile coho present on Scott Creek were only in the deepest, usually most complex, pools present at each site. In years when they were much more abundant coho used most habitats, except for riffles and shallow runs.

As in previous years, juvenile coho were larger than YOY steelhead on all three streams (Figures 1, 3 & 5), reflecting earlier spawning by coho. The few coho present on Scott Creek in 1998 were somewhat larger than in 1996, 1997 (Figure 2), apparently due to higher summer flows.

Waddell Creek. A total of 7 coho were captured at only two West Fork sites in Waddell Creek in 1998 (Table 2). Six of the fish came from from two deep pools at site 9, and a single fish came

from the next site upstream. In 1992 and 1995 floods destroyed redds on and downstream of the East Fork, but even in those years coho were more widespread on the West Fork and present at the two sites immediately downstream of the forks (Table 10). Although the West Fork was less affected by the 1998 storms than the remainder of the watershed, the damage was severe enough to apparently destroy almost all of the shallow redds of the precocial females that spawned.

Gazos Creek. Only 10 juvenile coho were captured on Gazos Creek (Table 3), with 9 of them captured at miles 5.1-5.2. Eight of those fish were captured at a log jam or in a large pool where a log jam had been removed. The only coho captured elsewhere on Gazos Creek came from a log jam pool downstream of Old Woman Creek. Spawning coho in 1998 would probably have been limited to precocial hatchery-reared fish, as wild production in 1995 was apparently very poor (Table 4); redds from these precocial fish would have been relatively shallow and vulnerable to storm damage. Because of the restricted distribution of captured coho, it is possible that only 1 redd partially survived the storms.

## Steelhead

Unlike coho, YOY steelhead abundance was very high in 1998 (Tables 1, 2, 3 & 5), reflecting steelhead's tendency to spawn after peak winter storms and the good rearing conditions provided by high summer streamflows. On Scott and Waddell creeks YOY densities were higher than previous years, and on Gazos Creek they were substantially higher than all years except 1995 (Table 5). However, yearling densities were relatively low (Table 5), which may reflect overwinter mortality due to the floods.

Scott Creek. YOY steelhead densities were substantially lower on upper Scott Creek (sites 11 and 11A), on Big Creek and on Scott Creek downstream of Big Creek (site 1) than elsewhere in the watershed in 1998 (Table 1). These are the sites usually impacted most by storm flows, so there may have been some impact of storms to steelhead fry survival at those sites.

YOY steelhead were largest in 1998 in Big Creek and on Scott Creek downstream of Big Creek (Figure 3), where summer streamflows were substantially higher. They were smallest on Mill Creek and upper Scott Creek (sites 9-11A and 13), which are heavily shaded and had the lowest summer streamflows (Figure 3). YOY steelhead sizes among sample years also generally reflect summer streamflow conditions. Steelhead at most sites were larger in 1998 and in 1995, another wet year, than in 1997, which had relatively low summer streamflows (Figure 3). However, on Mill Creek and on upper Scott Creek, there was little difference among years (Figure 3), perhaps because streamflows are usually low and shading heavy by the time fry emerge from the gravels at these cooler sites.

Waddell Creek. Lowest YOY steelhead densities on Waddell Creek were at sites 1 and 3 on lower Waddell Creek, where several sandy pools had low densities, and on the West Fork (sites 8-10) (Table 2), which had low summer flows and dense shading, similar to conditions on upper Scott Creek. YOY fish were substantially larger downstream of the forks (Figure 4), where flows were highest, canopy was generally more open and algal growth was greatest. YOY steelhead downstream of the forks showed larger size with increased summer streamflows; they were bigger in 1995 (wet) than in 1997 (dry), and even larger in 1998 (Figure 4); the majority of YOY steelhead in 1998 were larger than 75 mm, a size likely to trigger smolting as yearlings. On the shaded West Fork the fish were larger than in previous years, but the differences among years were less pronounced (Figure 4).

Gazos Creek. Lowest YOY steelhead densities were downstream of Old Woman Creek and at site 5 (Table 3), the sites with the heaviest stream shading. In some years the sites downstream of Old Woman Creek are siltier than upstream, but there was no apparent difference in 1998. YOY steelhead downstream of Old Woman Creek were larger in 1997 and 1998 than at upstream sites (Figure 5). However, there was no difference in size between years at either location, despite the substantial differences in streamflow between the two years.

## Mortality

No juvenile coho were apparently killed during sampling on Scott, Waddell or Gazos creeks or on Redwood Creek in Marin County in 1998 (Table 8). YOY steelhead mortality was 0.7 percent.

# MANAGEMENT IMPLICATIONS

As seen previously in 1992, 1995 and 1997, early spawning coho in Scott, Waddell and Gazos creeks are very vulnerable to redd destruction from heavy storms (Smith 1992, 1995b, 1998a). In 1998 the impacts were sufficient to produce very weak juvenile year classes, despite reasonably abundant spawning fish. On Gazos and Waddell creeks spawners were probably smaller precocial hatchery-reared fish, with shallow redds. However, on Scott Creek the spawners included an abundance of larger 3 year fish, and still the juvenile year class was nearly eliminated. The relatively mobile natural bed conditions of the three streams are probably a factor, as sand is abundant and many of the gravels are of low specific gravity mudstone. On Redwood Creek in Marin County the stream bed is composed primarily of heavier gravels, and juvenile density was not severely reduced in 1998, despite heavy stormflows (Smith 1998b). Additional large wood in the channel might help to stabilize the streambed somewhat, but would probably make little difference in a year as severe as 1998.

The 1998 year classes on all 3 streams are so weak that if they are recover artificial means are probably necessary. The few (about 70) coho produced in the Big Creek Hatchery could be held for 2 additional years and used for captive breeding. However, this drastic step of maintaining the fish in captivity for life would eliminate any natural selection and produce brood fish in 2001 from possibly only two parents. A less drastic, and more desirable, measure is available. The 1999 year class of spawners should be abundant, genetically diverse, and include an abundance of wild-produced fish. Accelerated growth among hatchery-produced fish in 1999 could provide sufficient precocial adult returns to rebuild the year class on Scott Creek, and possibly the other 2 streams, in the same way the 1995 and 1997 year classes rebounded on Scott Creek (Smith 1995b, 1998a). However, it is not encouraging for southern coho restoration prospects that in 5 of the last 9 years floods (1992, 1995, 1997, 1998) and delayed winter rainfall (1991) have weakened coho year classes so severely that hatchery-reared fish are necessary to restore the runs.

The storms did produce some longterm benefits, by adding to the supply of large woody debris on the three streams. However, the enthusiastic removal of log jams and downed logs on Gazos Creek demonstrates the need for a more coordinated and considered response. Many small log jams can be left in place to provide important overwintering habitat. Other log jams can be modified by cutting or removing key logs and leaving the rest of the wood to resort in the channel. Single leaning or fallen trees that threaten to become log jams in the wrong location can be redirected or cut in a way to reduce hazards to roads or bridges, while maintaining their potential to create complex pools. In addition to contingency planning to handle public works emergencies, there should also be contingency planning to take advantage of the tremendous habitat-improvement potential that storm events provide. If funds were quickly available many of the fallen trees could be relatively cheaply cut or moved within the channel in ways that would greatly increase their habitat benefit. Many habitat improvement projects suffer from lack of very large wood and the difficulty of getting it to the site; we should take advantage of situations where nature has done that part of the job for us.

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LITERATURE CITED

Shapovalov, L. and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (Salmo gairdneri gairdneri) and silver salmon (Oncorhynchus kisutch). California Department of Fish and Game Bulletin 98. 275 pp.

Smith, J. J. 1992. Distribution and abundance of juvenile coho and steelhead in Waddell, Scott, and Gazos creeks in 1992. 8 page unpublished report.

Smith, J. J. 1994a. Distribution and abundance of juvenile coho and steelhead in Scott and Gazos creeks in 1993. 15 page unpublished report.

Smith, J. J. 1994b. Abundance of coho and steelhead in Redwood Creek in 1994. Report to Golden Gate National Recreation Area, National Park Service. 10 pp.

Smith, J. J. 1994c. Distribution and abundance of juvenile coho and steelhead in Scott and Waddell creeks in 1988 and 1994: Implications for status of southern coho. 12 page unpublished report.

Smith, J. J. 1995a. Distribution and abundance of coho and steelhead in Redwood Creek in August 1995. Report to Golden Gate National Recreation Area, National Park Service. 9 pp.

Smith, J. J. 1995b. Distribution and abundance of coho and steelhead in Gazos, Waddell and Scott creeks in 1995. 20 page unpublished report.

Smith, J. J. 1996a. Distribution and abundance of coho and steelhead in Redwood Creek in November 1996. Report to Golden Gate National Recreation Area, National Park Service. 9 pp.

Smith, J. J. 1996b. Distribution and abundance of juvenile coho and steelhead in Gazos, Waddell and Scott creeks in 1996. 26 page unpublished report.

Smith, J. J. 1997. Distribution and abundance of coho and steelhead in Redwood Creek in Fall 1997. Report to Golden Gate National Recreation Area, National Park Service. 9 pp.

Smith, J. J. 1998a. Distribution and abundance of juvenile coho and steelhead in Gazos, Waddell and Scott creeks in 1997 and the implication for status of southern coho. 23 page unpublished report.

Smith, J. J. 1998b. Distribution and abundance of coho and steelhead in Redwood Creek in fall 1998. Report to Golden Gate National Recreation Area, National Park Service. 12 pp.

Smith, J. J. and L. Davis. 1993. Distribution and abundance of juvenile coho and steelhead in Waddell Creek in 1993. 7 page unpublished report.

Table 1. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet () at sites on Scott Creek in September and October 1998. (Site #s agree with earlier reports).

| Site | Mile >Hwy1 | Chan Type | %Hab Avail PL | GL | RN | RF | %Hab Sampl PL | GL | RN | RF | Sample Length (feet) | #SHT 0+ | 1+ | COHO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 <Little Creek | 1.9 | C3 | 40 | 35 | 15 | 10 | 54 | 32 | 14 | - | 239 | 164 (73) | 15 (7) | - |
| Big Creek | 2.15 | | | | | | | | | | | | | |
| 2 Pullout >Big Cr. | 2.55 | C4 | 50 | 30 | 15 | 5 | 72 | 20 | 8 | - | 186 | 191 (114) | 17 (9) | 1 (0.5) |
| 3 <Mill Creek | 3.05 | C4 | 50 | 30 | 15 | 5 | 96 | 4 | - | - | 115 | 107 (114) | 7 (7) | - |
| 4 <Swanton Road | 3.55 | C4 | 45 | 35 | 15 | 5 | 76 | 21 | 3 | - | 145 | 171 (128) | 10 (10) | 4 (3) |
| 5 Cattle Guard | 4.25 | C4 | 40 | 40 | 15 | 5 | 67 | 26 | 4 | 4 | 140 | 188 (166) | 19 (14) | 3 (2) |
| 7 Pullout <Big Cr. Gate | 4.9 | C4 | 45 | 35 | 15 | 5 | 73 | 12 | 11 | 4 | 213 | 310 (173) | 21 (10) | 6 (3) |
| 9 0.15 mi > bridge | 5.15 | C4 | 45 | 30 | 15 | 10 | 93 | 7 | - | - | 75 | 86 (138) | 9 (16) | - |
| 11 Upper Ford | 5.85 | C3 | 40 | 45 | 10 | 5 | 64 | 17 | 14 | 4 | 253 | 124 (54) | 10 (4) | 17 (8) |
| 11A 4th Trail Xing | 6.5 | B3 B1 | 35 | 10 | 40 | 15 | 88 | 12 | - | - | 124 | 73 (67) | 15 (14) | 3 (3) |
| 12 Big Cr. Swanton Rd. | | C3 | 25 | 20 | 35 | 20 | 71 | 12 | 13 | 4 | 171 | 89 (60) | 8 (5) | - |
| 13 Mill Cr. <Swanton Rd. | | C3 | 45 | 25 | 20 | 10 | 91 | 9 | - | - | 92 | 139 (158) | 9 (10) | - |
| Totals | | | | | | | | | | | 1753 | 1642 | 140 | 34 |
| Mean of 11 Sites | | | 42 | 30 | 19 | 9 | 77 | 16 | 6 | 1 | | (113) | (10) | (1.8) |

Table 2. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet () at sites on Waddell Creek in September and October 1998. (site #s agree with earlier reports).

| Site | Mile >Hwy1 | Chan Type | %Hab Avail PL | GL | RN | RF | %Hab Sampl PL | GL | RN | RF | Sample Length (feet) | #SHT 0+ | 1+ | Coho |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 First Bridge | 0.6 | C4 | 45 | 35 | 15 | 5 | 73 | 21 | 6 | - | 169 | 87 (54) | 6 (4) | - |
| 2 <Alder Camp | 1.35 | C4 | 45 | 40 | 10 | 5 | 65 | 20 | 15 | - | 101 | 120 (131) | 16 (18) | - |
| 3 Twin Redwoods | 1.8 | C4 | 45 | 35 | 15 | 5 | 77 | 18 | 4 | 2 | 286 | 134 (53) | 29 (11) | - |
| 4 Peri-winkle | 2.2 | C4 | 35 | 40 | 20 | 5 | 80 | 20 | - | - | 75 | 66 (123) | 4 (6) | - |
| 5 Pullout <Herbert | 2.6 | C3 | 55 | 25 | 15 | 5 | 92 | 8 | - | - | 215 | 145 (83) | 7 (4) | - |
| 6 Camp Herbert | 3.1 | C3 | 45 | 25 | 20 | 10 | 90 | 3 | 3 | 4 | 324 | 212 (81) | 18 (7) | - |
| 7 E Fork > Ford | 3.2 | C3 | 45 | 25 | 20 | 10 | 62 | 25 | 13 | - | 142 | 125 (115) | 7 (5) | - |
| 8 W Fork | 3.3 | C4 | 40 | 35 | 20 | 5 | 68 | 21 | 11 | - | 305 | 154 (60) | 8 (3) | - |
| 9 Mill Site | 3.9 | C4 | 50 | 30 | 15 | 5 | 75 | 26 | - | - | 235 | 106 (51) | 12 (7) | 6 (3) |
| 10 Trib @ Bridge | 4.7 | C1 C3 | 45 | 30 | 20 | 5 | 79 | 19 | 2 | - | 231 | 97 (45) | 13 (6) | 1 (0.4) |
| Totals | | | | | | | | | | | 2083 | 1246 | 120 | 7 |
| Mean of 10 Sites | | | 45 | 32 | 17 | 6 | 76 | 18 | 5 | 1 | | (80) | (7) | (0.3) |

Table 3. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet () at sites on Gazos Creek in August and September 1998. (Site #s 1-4 agree with earlier reports; sites 5-7 are new).

| Site | Mile >Hwy1 | Chan Type | %Hab Avail PL | GL | RN | RF | %Hab Sampl PL | GL | RN | RF | Sample Length | #SHT 0+ | 1+ | Coho |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.9 | C4 | 35 | 30 | 20 | 15 | 64 | 12 | 14 | 11 | 242 | 53 (24) | 11 (7) | - |
| 2 | 1.8 | C4 | 25 | 25 | 35 | 15 | 61 | 7 | 22 | 10 | 175 | 64 (45) | 17 (10) | 1 (0.6) |
| Old Woman Creek | 2.05 | | | | | | | | | | | | | |
| 2A | 2.1 | C4 | 30 | 30 | 25 | 15 | 58 | 15 | 6 | 21 | 122 | 49 (53) | 9 (7) | - |
| 3 | 3.15 | B4 | 35 | 20 | 30 | 15 | 34 | 24 | 25 | 16 | 237 | 131 (64) | 8 (3) | - |
| 4 | 4.4 | B4 | 35 | 20 | 25 | 20 | 64 | 15 | 3 | 18 | 177 | 104 (69) | 7 (4) | - |
| 5 | 4.8/5.0 | B4 | 30 | 30 | 25 | 15 | 77 | 14 | 9 | - | 112 | 39 (37) | 9 (8) | - |
| 6 | 5.1/5.2 | B4 B1 | 30 | 30 | 25 | 15 | 76 | 19 | 4 | 1 | 337 | 213 (67) | 29 (9) | 9 (2.7) |
| 7 | 5.3/5.45 | B1 | 40 | 5 | 35 | 20 | 92 | 8 | - | - | 127 | 70 (61) | 10 (8) | - |
| Totals: | | | | | | | | | | | 1529 | 723 | 100 | 10 |
| Mean of 8 Sites | | | 33 | 24 | 28 | 16 | 65 | 14 | 11 | 10 | | (53) | (7) | (0.4) |

Table 4. Number of sites, amount and type of habitat sampled, number of coho collected and estimated density (per 100 feet) for Scott, Waddell, Gazos and Redwood creeks in 1988 and 1992 - 1998.

| Stream and Date | Number of Sites Sampled | Length (feet) | Habitat Pl | Gl | Percent Rn | RF | % Sites w/coho | # | Coho Dens. (/100') |
|---|---|---|---|---|---|---|---|---|---|
| Scott Creek | | | | | | | | | |
| Jul-Sep 1988 | 14 | 3535 | 41 | 25 | 21 | 12 | 84 | 384 | 15.5 |
| Aug-Oct 1992 | 13 | 1624 | 66 | 30 | 4 | 0 | 46 | 42 | 4.3 |
| Jan 1994 | 11 | 1554 | 49 | 32 | 19 | 0 | 100 | 376 | 27.2 |
| Aug 1994 | 13 | 1744 | 59 | 36 | 6 | 0 | 46 | 17 | 1.1 |
| Oct 1995 | 12 | 1686 | 59 | 32 | 8 | 1 | 92 | 223 | 14.2 |
| Oct-Nov 1996 | 12 | 1684 | 62 | 30 | 8 | 1 | 100 | 473 | 33.0 |
| Aug-Sep 1997 | 13 | 1865 | 64 | 24 | 11 | 0 | 62 | 145 | 9.3 |
| Sep-Oct 1998 | 11 | 1753 | 77 | 16 | 6 | 1 | 64 | 34 | 1.8 |
| Waddell Creek | | | | | | | | | |
| Jun-Aug 1988 | 8 | 1817 | 54 | 19 | 23 | 5 | 63 | 19 | 1.3 |
| Jul-Aug 1992 | 13 | 2858 | 67 | 31 | 2 | 0 | 38 | 19 | 0.6 |
| Oct/Dec 1993 | 12 | 1857 | 38 | 21 | 28 | 14 | 75 | 58 | 3.6 |
| July 1994 | 12 | 2367 | 66 | 24 | 7 | 2 | 0 | 0 | 0 |
| Sep 1995 | 12 | 2498 | 64 | 24 | 10 | 2 | 58 | 24 | 1.1 |
| Aug-Sep 1996 | 14 | 2491 | 69 | 21 | 8 | 2 | 93 | 302 | 12.5 |
| Aug-Sep 1997 | 11 | 1873 | 58 | 32 | 8 | 1 | 0 | 0 | 0 |
| Sep-Oct 1998 | 10 | 2083 | 76 | 18 | 5 | 1 | 20 | 7 | 0.3 |
| Gazos Creek | | | | | | | | | |
| Aug 1992 | 2 | 275 | 44 | 56 | 0 | 0 | 0 | 0 | 0 |
| Jan 1994 | 4 | 503 | 65 | 22 | 12 | 1 | 50 | 9 | 2.2 |
| Nov 1995 | 4 | 425 | 58 | 19 | 21 | 3 | 25 | 1 | 0.2 |
| Sep 1996 | 5 | 830 | 49 | 27 | 12 | 13 | 100 | 33 | 4.9 |

Table 4 (continued)

| Stream and Date | | Number of Sites Sampled | Length (feet) | Habitat Pl | Gl | Percent Rn | RF | % Sites w/coho | # | Coho Dens. (/100') |
|---|---|---|---|---|---|---|---|---|---|---|
| Gazos Creek (continued) | | | | | | | | | | |
| Aug | 1997 | 5 | 827 | 45 | 28 | 17 | 10 | 0 | 0 | 0 |
| Aug-Sep | 1998 | 8 | 1529 | 65 | 14 | 11 | 10 | 25 | 10 | 0.4 |
| Redwood Creek | | | | | | | | | | |
| Jun-Sep | 1992 | 4 | 1032 | 37 | 40 | 5 | 7 | 100 | 426 | 45.3 |
| Jun-Aug | 1993 | 4 | 951 | 48 | 25 | 18 | 9 | 100 | 355 | 46.3 |
| July | 1994 | 7 | 1287 | 58 | 25 | 12 | 6 | 43 | 24 | 1.9 |
| Aug | 1995 | 4 | 796 | 41 | 30 | 19 | 10 | 100 | 308 | 42.0 |
| Nov | 1996 | 3 | 604 | 51 | 31 | 11 | 7 | 100 | 214 | 38.8 |
| Sep-Oct | 1997 | 5 | 984 | 72 | 18 | 9 | 1 | 60 | 209 | 23.3 |
| Oct | 1998 | 5 | 1174 | 59 | 25 | 15 | 1 | 100 | 327 | 31.6 |

Table 5. Number of sites, amount and type of habitat sampled, and estimated density (per 100 feet) of steelhead for Scott, Waddell, Gazos and Redwood creeks in 1988 and 1992 - 1998.

| Stream and Date | Number of Sites Sampled | Length (feet) | Habitat Percent Pl | Gl | Rn | RF | Density Age 0+ | Age 1/2+ |
|---|---|---|---|---|---|---|---|---|
| Scott Creek | | | | | | | | |
| Jul-Sep 1988 | 14 | 3535 | 41 | 25 | 21 | 12 | 57 | 7 |
| Aug-Oct 1992 | 13 | 1624 | 66 | 30 | 4 | 0 | 89 | 21 |
| Jan 1994 | 11 | 1554 | 49 | 32 | 19 | 0 | 39 | 21 |
| Aug 1994 | 13 | 1744 | 59 | 36 | 6 | 0 | 52 | 18 |
| Oct 1995 | 12 | 1686 | 59 | 32 | 8 | 1 | 90 | 10 |
| Oct-Nov 1996 | 12 | 1684 | 62 | 30 | 8 | 1 | 35 | 20 |
| Aug-Sep 1997 | 13 | 1865 | 64 | 24 | 11 | 0 | 68 | 7 |
| Sep-Oct 1998 | 11 | 1753 | 77 | 16 | 6 | 1 | 113 | 10 |
| Waddell Creek | | | | | | | | |
| Jun-Aug 1988 | 8 | 1817 | 54 | 19 | 23 | 5 | 45 | 7 |
| Jul-Aug 1992 | 13 | 2858 | 67 | 31 | 2 | 0 | 56 | 10 |
| Oct/Dec 1993 | 12 | 1857 | 38 | 21 | 28 | 14 | 54 | 8 |
| July 1994 | 12 | 2367 | 66 | 24 | 7 | 2 | 61 | 19 |
| Sep 1995 | 12 | 2498 | 64 | 24 | 10 | 2 | 79 | 14 |
| Aug-Sep 1996 | 14 | 2491 | 69 | 21 | 8 | 2 | 62 | 15 |
| Aug-Sep 1997 | 11 | 1873 | 58 | 32 | 8 | 1 | 71 | 7 |
| Sep-Oct 1998 | 10 | 2083 | 76 | 18 | 5 | 1 | 80 | 7 |
| Gazos Creek | | | | | | | | |
| Aug 1992 | 2 | 275 | 44 | 56 | 0 | 0 | 24 | 12 |
| Jan 1994 | 4 | 503 | 65 | 22 | 12 | 1 | 29 | 9 |
| Nov 1995 | 4 | 425 | 58 | 19 | 21 | 3 | 68 | 14 |
| Sep 1996 | 5 | 830 | 49 | 27 | 12 | 13 | 34 | 12 |

Table 5 (continued)

| Stream and Date | | Number of Sites Sampled | Length (feet) | Habitat Percent Pl | Gl | Rn | RF | Density Age 0+ | Age 1/2+ |
|---|---|---|---|---|---|---|---|---|---|
| Gazos Creek (continued) | | | | | | | | | |
| Aug | 1997 | 5 | 827 | 45 | 28 | 17 | 10 | 36 | 8 |
| Aug-Sep | 1998 | 8 | 1529 | 65 | 14 | 11 | 10 | 53 | 7 |
| Redwood Creek | | | | | | | | | |
| Jun-Sep | 1992 | 4 | 1032 | 37 | 40 | 5 | 7 | 23 | 4 |
| Jun-Aug | 1993 | 4 | 951 | 48 | 25 | 18 | 9 | 56 | 4 |
| Oct | 1994 | 5 | 1018 | 83 | 10 | 4 | 3 | 34 | 6 |
| Aug | 1995 | 4 | 796 | 41 | 30 | 19 | 10 | 96 | 4 |
| Nov | 1996 | 3 | 604 | 51 | 31 | 11 | 7 | 33 | 11 |
| Sep-Oct | 1997 | 5 | 984 | 72 | 18 | 9 | 1 | 15 | 5 |
| Oct | 1998 | 5 | 1174 | 59 | 25 | 15 | 1 | 47 | 4 |

Table 6. Changes in amount of pool habitat, pool depth, log jams, pools formed by large wood and other downed trees between 1997 and 1998 on Scott, Waddell and Gazos creeks.

| Site | Percent Pools 1997 | Pools 1998 | Pool Depth Change | 1997/1998 Log Jam/ Pools | Redwood Pools | Alder Pools | Other Log Pools | Other Down Trees |
|---|---|---|---|---|---|---|---|---|
| Scott Creek | | | | | | | | |
| 1 | 40 | 40 | +/- | | | | /1 | /1 |
| 2 | 45 | 50 | + | | 1/1 | | | /2 |
| 3 | 40 | 50 | + | | 1/1 | | | |
| 4 | 35 | 45 | + | /1 | 1/2 | | | 1/4 |
| 5 | 35 | 40 | + | /1 | | 2/2 | | /1 |
| 7 | 35 | 45 | +/- | | | | 1/1 | |
| 9 | 40 | 45 | +/- | | | 1/1 | | |
| 11 | 40 | 40 | - | | 1/1 | | | |
| 11A | 35 | 35 | + | | | | | |
| 12 | 20 | 25 | +/- | | | /1 | | /1 |
| 13 | 45 | 45 | +/- | /1 | | | /1 | |
| Total | 37 | 42 | +4 | /3 | 4/5 | 3/3 | 1/3 | 1/9 |
| | | +13% | +36% | | +25% | -- | +200% | +800% |
| | | | | -------8/14 = +75%------ | | | | |
| Gazos Creek | | | | | | | | |
| 1 | 30 | 35 | +/- | | | /1 | | /1 |
| 2 | 25 | 25 | +/- | /1 | | 1/1 | 1/1 | /2 |
| 2A | 30 | 30 | +/- | /1 | | | | |
| 3 | 35 | 35 | - | | 2/2 | | | /2 |
| 4 | 20 | 35 | + | | 1/1 | | /1 | /1 |
| Total | 28 | 32 | X | /2 | 3/3 | 1/2 | 1/2 | /6 |
| | | +14% | | | -- | +100% | +100% | |
| | | | | -------5/9 = +80%------ | | | | |

Table 6 (continued)

| Site | Percent Pools 1997 | Pools 1998 | Pool Depth Change | 1997/1998 Log Jam/ Pools | Redwood Pools | Alder Pools | Other Log Pools | Other Down Trees |
|---|---|---|---|---|---|---|---|---|
| Waddell Creek | | | | | | | | |
| 1 | 45 | 45 | + | 1/1 | | 1/1 | /1 | /4 |
| 2 | 35 | 45 | +/- | /1 | | 1/3 | | 1/4 |
| 3 | 40 | 45 | +/- | | /1 | 1/2 | | /2 |
| 4 | 35 | 35 | +/- | /1 | /1 | 2/2 | | /4 |
| 5 | 45 | 55 | + | /1 | | 1/2 | /1 | /4 |
| 6 | 45 | 45 | + | | 1/2 | | | |
| 7 | 45 | 45 | +/- | | 1/1 | /1 | | /3 |
| 8 | 35 | 40 | +/- | | 3/3 | | | /2 |
| 9 | 45 | 50 | + | 1/2 | 4/5 | /1 | | /2 |
| 10 | 30 | 45 | + | 1/1 | | | /1 | |
| Total | 40 | 45 | +5 | 3/7 | 9/13 | 6/11 | 1/3 | 1/26 |
| | | +12% | +50% | +133% | +44% | +83% | +200% | +2600% |
| | | | | 19/34 = +79% | | | | |

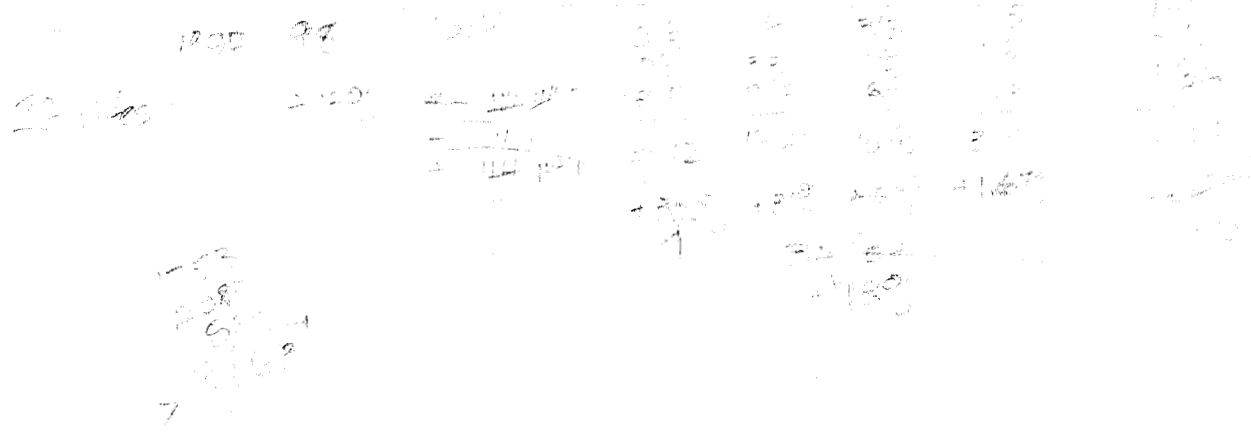

Table 7. Percent types of Pools present at sample sites on Scott, Waddell and Gazos creeks in 1998.

| Stream | Number of Pools | Bedrock Pool | Corner Pool | Root/SWD Pool | LWD Pool | | Log Jam | |
|---|---|---|---|---|---|---|---|---|
| | | | | | old | new | old | new |
| Scott Cr | n = 42 | 19 | 17 | 31 | 19 | 7 | 0 | 7 |
| Waddell Cr | n = 62 | 13 | 8 | 24 | 26 | 18 | 5 | 6 |
| Gazos Cr | n = 38 | 21 | 11 | 37 | 16 | 5 | 0 | 11 |

Table 8. Fish killed and captured ( / ) and mortality rate (%) for juvenile steelhead and coho captured by electroshocking on Waddell, Scott, Gazos and Redwood creeks in August - October 1998.

| | Steelhead | | | | Coho | |
|---|---|---|---|---|---|---|
| | Age 0+ | | Age 1+ | | Age 0+ | |
| | Kill/Capt | % | Kill/Capt | % | Kill/Capt | % |
| Waddell Creek | | | | | | |
| Sep-Oct | 4/1246 | 0.3 | 0/120 | 0.0 | 0/7 | 0.0 |
| Scott Creek | | | | | | |
| Sep-Oct | 17/1642 | 1.0 | 1/140 | 0.7 | 0/37 | 0.0 |
| Gazos Creek | | | | | | |
| Aug-Sep | 5/723 | 0.7 | 0/100 | 0.0 | 0/10 | 0.0 |
| Redwood Creek | | | | | | |
| Sep-Oct | 4/481 | 0.8 | 0/45 | 0.0 | 0/327 | 0.0 |
| Totals | 30/4092 | 0.7 | 1/405 | 0.2 | 0/381 | 0.0 |
| Overall | | | 31/4878 | 0.6 | | |

Table 9. Site locations and coho densities ( / 100') in September 1992, January 1994 (1993 Year Class), October 1995, October and November 1996, August and September 1997 and September and October 1998 on Scott Creek.

| Site | Mile >Hwy1 | Year Class Density 1992 | 1993 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|
| A Near Diversion | 0.9 | | 1.9 | 1.2 | 22* | 0 | |
| 1 <Little Creek | 1.9 | 2.0 | 7 | 14 | 33* | 0 | 0 |
| Big Creek | 2.15 | | | | | | |
| 2 Pullout >Big Cr. | 2.55 | 0 | 31 | 29 | 31 | 30 | 0.5 |
| 3. < Mill Creek | 3.05 | 0.7 | | 28 | | 29 | 0 |
| 4 <Swanton Road | 3.55 | 0 | 86 | 26 | 37 | 20 | 3.1 |
| 7 Pullout <Big Cr. Gate | 4.9 | 23 | 48 | 23 | 62 | 24 | 2.9 |
| 9 0.15 mi > bridge | 5.15 | 1.2 | 39 | 12 | 62 | 1.0 | 0 |
| 11 Upper Ford | 5.85 | 1.6 | 41 | 5 | 33 | 0 | 8.1 |
| 11A 4th Trail Xing | 6.5 | | 16 | 2.6 | 31 | 0.8 | 3.2 |
| 12 Big Cr. Swanton Rd. | | 0 | 8 | 1.0 | 21 | 0 | 0 |
| 12A Big Cr. Below Hatchery | | | 9 | 0 | 30 | 0 | |
| 12B Big Cr. >Berry Cr. | | | | | 11 | | |
| 13 Mill Cr. <Swanton Rd. | | 0 | 12 | 28 | 24 | 6 | 0 |
| Mean | | 4.3 | 27.2 | 14.2 | 33.0 | 9.3 | 1.8 |

*Augmented by plants of fry from Big Creek Hatchery

Table 10. Site locations and coho densities ( / 100') in July-August 1992, October 1993, September 1995, August-September 1996, and September-October 1998 on Waddell Creek.

| Site | Mile >Hwy1 | Year Class Density 1992 | 1993 | 1995 | 1996 | 1998 |
|---|---|---|---|---|---|---|
| 1 >Div | 0.6 | 0 | 1 | 0.5 | 16* | 0 |
| 2 <Alder Camp | 1.35 | 0 | 0.3 | 0.3 | 7* | 0 |
| 3 Twin Redwoods | 1.8 | 0 | 0 | 0 | 14* | 0 |
| 4 Peri-winkle | 2.2 | 0 | 4 | 0 | 30* | 0 |
| 5 Pullout <Herbert | 2.6 | 0.4 | 4 | 2.2 | 16* | 0 |
| 6 Camp Herbert | 3.1 | 2.2 | | 1.5 | 15* | 0 |
| 7 E Fork > Ford | 3.2 | 0 | 2 | 0 | 10 | 0 |
| 14 E Fork | 3.7 | | 4 | | 4 | |
| 8 W Fork | 3.3 | 3.5 | 7 | 2.7 | 13 | 0 |
| 9 Mill Site | 3.9 | 0.4 | 4 | 2.6 | 23 | 2.7 |
| 10 Trib @ Bridge | 4.7 | 0.8 | 0 | 2.9 | 18 | 0.4 |
| 11 HenryCr Trail | 5.25 | 1.0 | 2 | 0 | 7 | |
| Slippery Falls | 5.35 | | | | | |
| 12 Upper Bridge | 5.45 | 0 | 0 | | 0 | |
| 13 HenryCr >Trail | 0.2 | 0 | 16 | 0 | 3 | |
| Means | | 0.7 | 3.6 | 1.1 | 12.5 | 0.3 |

*Augmented by plants of fry from Big Creek Hatchery

Figure 1. Standard lengths (mm) of YOY steelhead from sites 2, 9 & 11 and coho from sites 2 and 4-11 on Scott Creek in September and October, 1998.

| | Steelhead | Coho |
|---|---|---|
| 30 - 34 | *5 | |
| 35 - 39 | *******21 | |
| 40 - 44 | **********50 | 1 |
| 45 - 49 | **********66 | |
| 50 - 54 | **********96 | |
| 55 - 59 | **********76 | ***7 |
| 60 - 64 | **********49 | ******13 |
| 65 - 69 | ********26 | *****10 |
| 70 - 74 | ***11 | **4 |
| 75 - 79 | *5 | *2 |
| 80 - 84 | 1 | |

Figure 2. Scott Creek coho standard lengths (mm) at sites 2 and 4 in November 1996, sites 2-7 in August-September 1997 and sites 2 - 11 in September and October 1998.

| | 1996 | 1997 | 1998 |
|---|---|---|---|
| 40 - 44 | | | 1 |
| 45 - 49 | *4 | 1 | |
| 50 - 54 | *******22 | ********25 | |
| 55 - 59 | **********34 | **********46 | ***7 |
| 60 - 64 | ********24 | **********35 | ******13 |
| 65 - 69 | *****15 | *****15 | *****10 |
| 70 - 74 | **8 | **6 | **4 |
| 75 - 79 | 1 | 2 | *2 |
| 80 - 84 | | 2 | |
| 85 - 89 | | 2 | |

Figure 3. Standard Lengths (m) of YOY steelhead from Scott Creek in October 1995, September 1997, and September and October 1998. Site A & 1 sizes were typical of those downstream of Big Creek (sites A and 1) and lower Big Creek in 1998; Site 2 sizes were typical of Scott Creek sites 3-6 and Big Creek in 1995 and 1997; Site 9 & 11 sizes were typical of upper Scott Creek and Mill Creek (sites 9-11A, 13).

---

| | Sites A & 1 1997 | Site A 1995 | Site 1 1998 |
|---|---|---|---|
| 40 - 44 | *4 | | |
| 45 - 49 | **8 | | |
| 50 - 54 | *****15 | 1 | 2 |
| 55 - 59 | *****16 | **7 | *******23 |
| 60 - 64 | ******18 | ***11 | **********36 |
| 65 - 69 | *****15 | *********29 | **********36 |
| 70 - 74 | ***11 | ******19 | **********38 |
| 75 - 79 | ***10 | ******20 | ***10 |
| 80 - 84 | *3 | ****13 | *3 |
| 85 - 89 | | ****12 | ***9 |
| 90 - 94 | 1 | **8 | *3 |
| 95 - 99 | 1 | *3 | *3 |
| 100-104 | | *4 | |

| | ----------Site 2---------- | | |
|---|---|---|---|
| | 1997 | 1995 | 1998 |
| 30 - 34 | 2 | | |
| 35 - 39 | *4 | *4 | 1 |
| 40 - 44 | ****12 | **********33 | *5 |
| 45 - 49 | ******18 | *********29 | *******22 |
| 50 - 54 | *****17 | ********25 | **********48 |
| 55 - 59 | ******18 | ******19 | **********50 |
| 60 - 64 | ****13 | *********27 | **********35 |
| 65 - 69 | 1 | *****16 | *****16 |
| 70 - 74 | *4 | *****16 | ***10 |
| 75 - 79 | 1 | ***11 | *5 |
| 80 - 84 | | 2 | 1 |

| | ----------Sites 9 & 11---------- | | |
|---|---|---|---|
| | 1997 | 1995 | 1998 |
| 30 - 35 | *3 | *5 | *5 |
| 35 - 39 | *******22 | *****17 | ******20 |
| 40 - 44 | **********38 | ********25 | **********45 |
| 45 - 49 | **********34 | *******23 | **********44 |
| 50 - 54 | **********31 | ********26 | **********48 |
| 55 - 59 | **********31 | ******19 | ********26 |
| 60 - 64 | ****14 | ***9 | ****14 |
| 65 - 69 | ***10 | *4 | ***11 |
| 70 - 74 | | 2 | 1 |

Figure 4. Waddell Creek YOY steelhead standard lengths (mm) from Waddell Creek (site 3) in 1997, 1995 and 1998 and West Fork Waddell Creek (site 8) in 1997, 1995 and 1998 and coho lengths from sites 9 and 10 in 1998.

| | Site 3 | | | Site 8 |
|---|---|---|---|---|
| | 1997 | 1995 | 1998 | 1998 |
| 35 - 39 | | | | |
| 40 - 44 | *4 | | 1 | 1 |
| 45 - 49 | ****14 | 1 | | *******22 |
| 50 - 54 | ******19 | **6 | 1 | *********28 |
| 55 - 59 | ********24 | ***14 | 1 | **********34 |
| 60 - 64 | ******19 | ******18 | ***9 | *****15 |
| 65 - 69 | ***9 | ****13 | ******18 | ******20 |
| 70 - 74 | ***11 | ****12 | *****16 | ******18 |
| 75 - 79 | ***11 | ****13 | ********24 | ***10 |
| 80 - 84 | *5 | ***9 | ******19 | *4 |
| 85 - 89 | **6 | **6 | ****13 | *4 |
| 90 - 94 | *3 | 2 | ****14 | 1 |
| 95 - 99 | | | **6 | |
| 100-104 | | | ***9 | |
| 105-109 | | | *4 | |

| | Site 8 Steelhead | | | Site 9/10 |
|---|---|---|---|---|
| | 1997 | 1995 | 1998 | Coho 1998 |
| 35 - 39 | **7 | 2 | | |
| 40 - 44 | ****13 | ***10 | 1 | |
| 45 - 49 | ******19 | ****14 | *******22 | |
| 50 - 54 | *********27 | ********25 | *********28 | |
| 55 - 59 | *********27 | *****16 | **********34 | |
| 60 - 64 | ***9 | ****12 | *****15 | * |
| 65 - 69 | **7 | **8 | ******20 | * |
| 70 - 74 | *3 | **7 | ******18 | ** |
| 75 - 79 | 2 | **6 | ***10 | ** |
| 80 - 84 | | *5 | *4 | * |
| 85 - 89 | | | *4 | |
| 90 - 94 | | | 1 | |

Figure 5. Standard lengths (mm) of steelhead and coho from sites 1 and 2, 4 and 6 on Gazos Creek in August 1997 and August and September 1998.

Steelhead

| | --Sites 1 & 2- 1997 | 1998 | -----Site 4---- 1997 | 1998 |
|---|---|---|---|---|
| 30 - 34 | | | 2 | |
| 35 - 39 | | | *5 | 1 |
| 40 - 44 | 2 | | ****14 | ***14 |
| 45 - 49 | 2 | 1 | ****13 | **********33 |
| 50 - 54 | ****13 | ******18 | ******20 | ********25 |
| 55 - 59 | ******18 | **********28 | ****14 | *****17 |
| 60 - 64 | ****13 | ******18 | ****12 | **7 |
| 65 - 69 | **6 | **********33 | *4 | *4 |
| 70 - 74 | ***11 | ****12 | *4 | 1 |
| 75 - 79 | **6 | *3 | | 2 |
| 80 - 84 | 2 | *3 | | |
| 85 - 89 | | | | |
| 90 - 94 | | 1 | | |

Site 6 1998

| | Steelhead | Coho |
|---|---|---|
| 45 - 49 | **8 | |
| 50 - 54 | *******23 | |
| 55 - 59 | ********************54 | |
| 60 - 64 | **********28 | |
| 65 - 69 | *****17 | *1 |
| 70 - 74 | ***10 | ********8 |
| 75 - 79 | *5 | |
| 80 - 84 | 2 | |